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May 1, 1957

SECRET

25X1

Subject: Contract RD-81, Task VI

Sir:

You recently requested cost breakdown of blasting caps to be supplied under subject task. We have received the following quotations from our East Alton, Illinois plant:

Material	$14.09
Labor	8.00
Burden	18.00
Packing	3.41
Tool Alteration	50.00
Sub Total	$93.50
G & A	2.61
Sub Total	$96.11
Fee	6.89
Total	$103.00

25X1

Very truly yours,

OLIN MATHIESON CHEMICAL CORPORATION
Winchester-Western Division

25X1

Industrial & Military Department

EFM/lfm

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February 5, 1957

Dear Ralph:

I am quoting the following additional information:

"Please note that the J-1 detonator does not contain an ignition charge on top of the lead azide priming charge, whereas the Olin special detonator does. We believe that for the uses to which your detonators might conceivably be put and the particularly adverse storage conditions which they might be required to stand, you would be better pleased with the performance of the Olin special and its top ignition charge. Particularly for in-expert users, who may not cut fuse in the proper manner and who may not crimp the detonator in the best manner, the lead styphnate ignition charge is added insurance against misfires."

Let me know if more data is required.

25X1

[redacted]

Yours,
Olin Mathieson Chemical Corp.
Blasting Agents

FEB 10 3:30 1957

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INFORMATION ON SPECIAL NON-ELECTRIC DETONATORS

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Two types of non-electric special detonators are available: (1) Engineers Corps Special Cap, J-1; (2) Olin Special Cap. The characteristics, cost, and availability of these caps are as follows:

Cap Specifications

Characteristics	J-1	Olin Special
Over-all Length	2.344"	1.75"
Inside Diameter	0.221"	0.224"
Base Charge (RDX)	13.5 - 15.0 grains	10.34 grains
Priming Charge (Lead Azide)	4 - 5 grains	4.8 grains
Ignition Charge (Lead Styphnate)	None	1.1 grains

Cost and Delivery Schedule

The J-1 cap can be delivered in any quantity within 2 weeks of order date for a cost of $55 per 1,000 caps.

The Olin Special Cap will require an initial tooling cost of $500 for any desired quantity of caps. The cost thereafter will be $60 per 1,000 caps. The first 1,000 caps can be delivered 6 weeks after order date, 5,000 caps can be delivered 7 weeks after order date, and 10,000 caps can be delivered 8 weeks after order date.

Packaging and Identification

Neither cap carries any identification or other stamps on the gilding metal case.

The caps can be either can packed, 50 caps per can, in a screw top can fitted with a rubber gasket, or in cardboard boxes. Neither the screw top can nor the cardboard box will carry any identification or printed material. The cost of the caps quoted above includes either type of packaging.

5000 # 60 / 300 / 500 / 800 Olin Special Cap. metal case

Jan. 29, 1957

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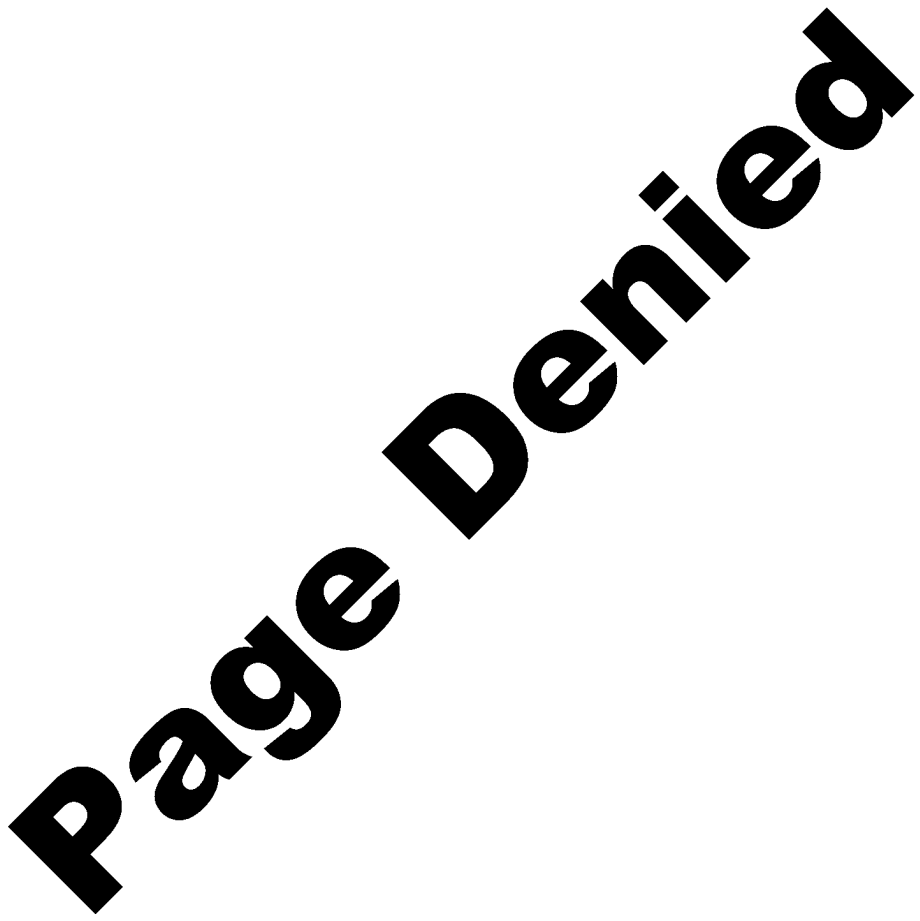

DATA SHEET

LOW ENERGY DETONATING CORD

The Ensign-Bickford Company

Simsbury, Connecticut

July 15, 1957
First Revision

DATA SHEET

LOW ENERGY DETONATING CORD

Ensign-Bickford Company and E. I. du Pont de Nemours & Company have jointly developed a radically new detonating cord whose unique properties suggest a number of interesting uses.

DESCRIPTION

Low Energy Detonating Cord (LEDC) consists of a very small, continuous column of explosive in a metal tube. A number of different explosives have been found satisfactory. Core loads in a wide range can be prepared and will function. Furthermore, we are able to build up the metal tube with reinforcing structures of textiles and plastics or wires to resist abusive use in the field.

The most extensive samples of Low Energy Detonating Cord made to date have contained a core load of PETN encased in a metal tube. Although a wide range of core loads will detonate, our principal efforts have been devoted to loads of one and two grains per foot of PETN in an 0.040" O.D. metal tube.

PROPERTIES

The properties of these cords are as follows:

1. **Low Brisance**

   LEDC has little value as an initiator through its side and will not consistently initiate itself or some explosives laid adjacent to it if unconfined. It will initiate explosives placed in immediate contact with an end.

2. **Uniform High Velocity**

   The velocity of LEDC is in the same range as Primacord detonating fuse - approximately 6500 meters per second.

3. **Incendiary Effects**

   When the metal-covered LEDC is initiated, it throws out radially a hot shower of metal at a rate approximately one-fifteenth of its detonation rate. This hot metal is apparently an excellent initiator for propellants.

POTENTIAL USES

Because of the properties indicated above, certain unique uses of Low Energy Detonating Cord are indicated:

1. Noiseless Mainline

Because of its low noise, it may be used as a mainline in Primacord blasting in or near residential areas.

2. Bottom Initiation of Cap Sensitive Powders

With proper insulating buildup LEDC will not initiate some explosives laid alongside it. LEDC may therefore find use where bottom initiation of explosives is desired. In quarry work, where the holes are loaded with cap-sensitive explosives, LEDC may be used in lieu of electric blasting to avoid lightning hazards.

3. Short Delays

Because certain types will not cross-initiate or cut off, LEDC can be wound in spirals upon itself to provide delay firing of any period desired. It is particularly adapted for obtaining periods of delay under one millisecond.

4. Propellant Igniter

The detonation of LEDC disperses radially hot metal particles which have ignition properties and might serve as a high velocity initiator for propellant powder. Because of the low disruptive effect of the LEDC, it may be possible to take advantage of many desired geometric shapes and yet get high velocity initiation across a plain surface.

5. Mechanical Applications

The weak, but controlled, application of force from LEDC suggests a number of mechanical applications. These include explosive disconnects, crimping of metals, and de-icing airplane wings.

6. Military [redacted]

Because of its low brisance, Low Energy Detonating Cord may find application in military components where it is desired to carry detonation from one place to another past sensitive equipment. Conventional Primacord would require heavy, costly shielding; whereas Low Energy Detonating Cord may permit significant weight reduction where it is desired to convey detonation without powerful explosive effects.

VAILABILITY

s indicated above, Low Energy Detonating Cord can be prepared ith many different explosives, in many different core loads, and many different exterior sizes. The following tentative types h v been made:

Type T1. .040" O.D. metal tube loaded with 2 grains per foot PETN.

Type T2. .092" diameter metal tube filled with 2 grains per foot PETN. Available only on special request.

Type T3. The same core as in Type 1, built up with textiles and plastic to an outside diameter of 0.210". No longer available.

Type T4. .240" O.D. 2 grains per foot. .040" O.D. lead tube containing 2 grains per foot PETN built up with textiles and plastics to an O.D. of .240". This cord is intended for downlines for bottom initiation.

Type T5. Wire Countered 2 grains LEDC. .040" O.D. metal tube loaded with 2 grains per foot PETN covered with 5 ends steel wire applied clockwise and 5 ends steel wire applied counterclockwise to provide for resistance to abuse. This cord is intended for a noiseless mainline.

Type T6. .040" O.D. metal tube loaded with one grain per foot PETN.

Type T7. .240" O.D. one grain per foot. .040" lead tube containing one grain per foot PETN built up with textiles and plastics to an O.D. of .240". This cord is intended for downlines for bottom initiation.

Type T8. Wire Countered one grain LEDC. .040" O.D. metal tube loaded with one grain per foot PETN covered with 5 ends steel wire applied clockwise and 5 ends steel wire applied counterclockwise to provide for resistance to abuse. This cord is intended for a noiseless mainline.

All types of LEDC are to be considered tentative in view of the continuing research work on improving the properties of this new development.

CAUTIONS

The principal caution when using Low Energy Detonating Cord is "care in hook-up." Proper functioning of the small explosive train may be assured if the detonator is firmly seated against a cut end of LEDC.

LEDC should never be inserted into a detonator containing static sensitive powder, i.e., an ordinary or fuse blasting cap.

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Please return to ED

rec'd 1:00 10/31/58

Data Sheet

PRIMACORD Detonating Fuse

file

Demo Access Det. Cord.

The Ensign-Bickford Company

Simsbury, Connecticut

25X1

[redacted]

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DATA SHEET - PRIMACORD Detonating Fuse

Introduction

The Ensign-Bickford Company booklet entitled "Primacord-Bickford Detonating Fuse" describes the four stock brands of Primacord detonating fuse (Plain, Reinforced, Wire Countered Plastic, and Reinforced Plastic Primacord detonating fuse) and outlines their use in normal commercial blasting. In the last few years a number of special types of Primacord detonating fuse have been developed to meet specific field problems. This data sheet is prepared to outline the properties of certain special types available. It is hoped this outline will assist the customers in selection of the type of cord most suited for a specific job. In most instances a stock brand of cord will probably best serve the customer's interest. In case of question the technical staff of Ensign-Bickford is always available for counsel on which type of cord to use in a given application.

General Comments on Properties of Special Primacord

As indicated above, the special types of Primacord detonating fuse have been developed to meet specific problems. To meet these problems a number of the properties of the Primacord have been modified. Modifications have been made in the type of explosive used, explosive load, physical strength, and type of finish. Each of the modifications is treated separately.

Type of Explosive

To date Primacord has been made with two explosives, PETN (Pentaerythrite tetranitrate) and RDX (Cyclotrimethylenetrinitramine). These explosives are approximately equal in power and brisance. RDX is less sensitive to initiation and will withstand higher temperatures than will PETN. The melting point of PETN is approximately 285° F. while RDX melts at approximately 385° F.

Except where exposure to temperatures above 225° F. is encountered, PETN core Primacord is recommended. For purposes of identification the explosive in RDX Primacord is tinted pink. PETN is white. A comparison of some of the properties of PETN Primacord and RDX Primacord is given in tabular form below:

	PETN PRIMACORD	RDX PRIMACORD
Velocity	Approximately the same, with average values about 6300 - 6400 meters per second.	
Initiation	Dry PETN PRIMACORD can be initiated by side priming with a #6 or stronger cap. (The detonator should be taped tightly alongside the cord and pointed in the direction. of the charge.)	RDX PRIMACORD is less sensitive to initiation than is PETN PRIMACORD. It cannot be consistently initiated by side priming with either a #6 or #8 cap. End priming, that is butting the end of the blasting cap against a fresh square cut end of cord, or the use of a booster, is required for consistent initiation.

Initiation (Continued)		A du Pont C-63 booster which can be conveniently attached by crimping to the #70 RDX PRIMACORD is a suitable booster. (du Pont's P-11 booster is suitable for use with #100 RDX PRIMACORD).
Initiation when wet (assuming the waterproofing has been damaged and the explosive core wet.)	Wet PETN PRIMACORD can be initiated by end priming with a #6 cap, and will propagate continuously once initiated. (Except those Primacord containing less than 40 grain/ft. of PETN).	Wet RDX PRIMACORD cannot be initiated with certainty by end priming with a #6 or #8 cap. Consistent propagation in continuous length cannot be assured on wet RDX PRIMACORD.
Dependent Connections	Dry PETN PRIMACORD will satisfactorily communicate the detonation wave through any of the standard knotted connections. (A wet length of PETN PRIMACORD cannot be initiated by another length of Primacord - wet or dry - in a dependent connection unless a booster is used.) Wet and frozen Primacord is less sensitive than wet Primacord but may be initiated with end priming using a #6 cap or by using a du Pont Primacord Primer, or the equivalent of approx. one-half stick of 80% high velocity gelatin dynamite. (Note: The sensitivity of dry PETN PRIMACORD is not affected by sub-freezing temperatures.)	Because of its low sensitivity it is recommended that no knotted dependent connections be used in hook-ups with RDX PRIMACORD.
Heat Resistance	Will withstand 225° F. for two hours and detonate satisfactorily.	Will withstand 325° F. for two hours and detonate satisfactorily.

Quality of Explosive

PETN PRIMACORD, a textile detonating fuse, has been supplied in loadings from 30 grains per foot up. Except for special circumstances requiring minimum explosive force, the use of core loadings less than 40 grains is not recommended.

RDX PRIMACORD has been supplied in loadings from 70 grains per foot up. RDX PRIMACORD is not supplied in core loadings under 70 grains per foot, as experience has shown that at lower loadings (50 grains per foot or less) it does not perform

reliably in textile detonating fuse. In other words, because RDX is less sensitive than PETN it will not detonate reliably in as small a column of explosive.

Special uses have required core loadings up to 400 grains per foot and in one instance a loading of approximately 1500 grains per foot was successfully prepared in a single strand. Further, by stranding a number of small cords, large "cables" may be made. No listing is made here of these cords, but if customers require larger loadings, such cords can be produced.

Physical Strength

All of the types of Primacord have a central structure known as the raw core, consisting of the explosive encased in a textile braid. In a few rare instances this core has been supplied to customers; however, it is not recommended except in very unusual circumstances. In case of question regarding the use of a raw core it is suggested that The Ensign-Bickford Company be contacted.

Generally the raw core is covered with waterproofing materials, textiles, and finishes to build up its water resistance, tensile strength, abrasion resistance, and resistance to handling and abuse. Different types of cord, according to the physical strength are as follows:

Plain	- coated with asphalt*, a tape, textile counterings, and wax finish
Reinforced	- coated with asphalt*, a tape, textile counterings double that on Plain Primacord, and a wax finish
	* asphalt omitted on RDX Primacord
Plastic Wire Countered	- coated with asphalt, wire, high tenacity rayon, and plastic to give resistance to extremely severe conditions of rough handling and wet exposure
Plastic Reinforced	- coated with asphalt, high tenacity rayon, and plastic to give resistance to severe conditions

Other types of construction have been devised to meet special requirements.

Finishes

Wax - The Plain and Reinforced grades of Primacord are normally finished with a wax mixture. This finish anchors the textiles in place, enhances the water resistance and assists in preventing knot connections from slipping. A yellow dye is incorporated in the wax mixture.

Plastic-Polyethylene - Polyethylene plastic has been used as a finish coat to give waterproof detonating fuse. Primacord coated with polyethylene will withstand exposure to water under pressure for indefinite periods. Polyethylene also gives excellent flexibility at low temperature. Polyethylene jackets can be supplied over raw core Primacord or textile reinforced cords. Colored polyethylene can be supplied, but normally, natural, or white, translucent polyethylene is used.

Plastic "Vinylite" - For exposure to high temperatures in aqueous mixtures or refined oils a special heat and oil resistant grade of Vinylite has been applied as a finish coat to Primacord. The "Vinylite" used is black.

"Hycar" Rubber - To meet the most extreme condition of exposure to crude oil and well fluids under high temperature and high pressure, a "Hycar" rubber (Buna-N) jacket is applied to RDX Primacord. This jacket is also black.

Other finishes - White Solution - In certain instances where no water resistance is required and a non-softening or non-fusible finish is desired, a mixture of clay and glue, known as white solution, has been applied as a finish to the outer textile counterings on Primacord.

Speed Tested and High Velocity Primacord

As indicated earlier, the detonating velocity of Primacord averages about 6300 to 6400 meters per second. Primacord is available, which has been checked for speed and can be used in the D'autriche method for testing the detonating rate of explosives.

Further, for certain requirements, particularly in gun perforating oil wells, Primacord of high velocity (above 6500 m/s) is available. The letters HV are used to designate high velocity Primacord which is available at a small additional cost. Recent production of HV Primacord has given average velocities above 6900 m/s.

With the discussion of properties as a background, the following tabulation of properties of types of Primacord serves as a guide to their use:

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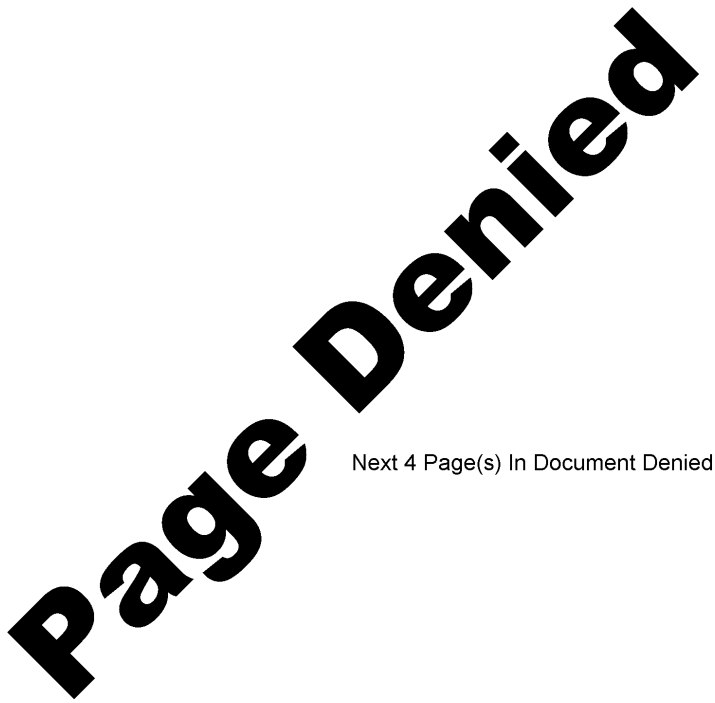
1/31/57 - 4th Revision



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